

**SECTION 03450
PLANT-PRECAST ARCHITECTURAL CONCRETE**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Precast concrete stair treads and landings with polished finish.
- B. Related Sections:
 - 1. Division 7 Section "Sheet Metal Flashing and Trim" for flashing receivers and reglets.
 - 2. Division 7 Section "Joint Sealants" for elastomeric joint sealants and sealant backings.

1.2 PERFORMANCE REQUIREMENTS

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixes: For each concrete mix.
- C. Shop Drawings: Detail fabrication and installation of precast architectural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.
 - 1. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
 - 2. Indicate locations and details of anchorage devices to be embedded in other construction.
- D. Samples: For each type of finish indicated on exposed surfaces of precast architectural concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches. Provide samples for the following finishes:
 - 1. Stair tread and landings: Polished finish.
- E. Welding Certificates: Copies of certificates for welding procedures and personnel.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Concrete materials.
 - 2. Reinforcing materials and prestressing tendons.
 - 3. Admixtures.
 - 4. Bearing pads.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed precast architectural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Fabricator Qualifications:** A firm that complies with the following requirements and is experienced in manufacturing precast architectural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 2. **Engineer Qualifications:** A State of Tennessee Licensed Professional Engineer and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast architectural concrete that are similar to those indicated for this Project in material, design, and extent.
 - 3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group A, Category A1--Architectural Cladding and Load Bearing Units.
 - 4. Has sufficient production capacity to produce required units without delaying the Work.
 - 5. Is registered with and approved by authorities having jurisdiction.
- C. **Testing Agency Qualifications:** An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. **Design Standards:** Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
- E. **Quality-Control Standard:** For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- F. **Welding:** Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- G. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver precast architectural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.
- B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.6 SEQUENCING

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
 - 1. Gate Bluegrass Precast, Inc.
 - 2. Metromont Prestress

2.2 MOLD MATERIALS

- A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82, galvanized.
- C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from galvanized steel wire into flat sheets.
- D. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 117, and as follows:
 - 1. For uncoated reinforcement, use CRSI Class 1 plastic-protected bar supports.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, white of same type, brand, and source.
 - 1. Standard gray portland cement may be used for nonexposed backup concrete.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.
 - 1. Face-Mix Coarse Aggregates: Locally selected, hard, and durable; free of material that reacts with cement or causes staining.
 - a. Gradation: Uniformly graded.
 - 2. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Construction Manager.
- C. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- E. Admixture: Provide admixtures certified by manufacturer to be compatible with other required admixtures, and complying with the following:
 - 1. Air-Entraining Admixture: ASTM C 260
 - 2. Water-Reducing Admixture: ASTM C 494, Type A.
 - 3. Retarding Admixture: ASTM C 494, Type B.
 - 4. Plasticizing Admixture: ASTM C 1017.
 - 5. Fly Ash Admixture: ASTM C 618, Class C or F.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.
- C. Carbon-Steel Plate: ASTM A 283/A 283M.
- D. Malleable Steel Castings: ASTM A 47 ([ASTM A 47M](#)).
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 ([Grade 415-205](#)).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
- H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 ([Grade 450](#)).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A ([ASTM F 568M](#), [Property Class 4.6](#)); carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
- K. Welding Electrodes: Comply with AWS standards.
- L. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast architectural concrete units.

2.6 GROUT MATERIALS

- A. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application.

2.7 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
 - 1. Limit use of fly ash and silica fume to not exceed, in aggregate, 25 percent of portland cement by weight.

- B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.
- D. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- G. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.8 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing operations.
- B. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

2.9 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- B. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast architectural concrete units to receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.
- D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcement to maintain at least 3/4-inch minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position

- while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.
 - F. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
 - G. Place face mix to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover.
 - H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.
 1. Place backup concrete to ensure bond with face mix concrete.
 - I. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.
 - J. Comply with ACI 306.1 procedures for cold-weather concrete placement.
 - K. Comply with ACI 305R recommendations for hot-weather concrete placement.
 - L. Identify pickup points of precast architectural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure.
 - M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
 - N. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Construction Manager.

2.10 FABRICATION TOLERANCES

- A. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.11 FINISHES

- A. Precast Stair Treads and Landings: Finish exposed-face surfaces of precast concrete stair treads and landings to match approved design reference sample for polished finish and as follows:
 1. Polished-Surface Finish: Provide polished surfaces free of pockets, streaks, and honeycombs, with uniform color and texture.
 2. Polished finish to match polished concrete floor finish.

3. Finish exposed top, bottom and back surfaces of precast architectural concrete units to match face-surface finish.
- B. Finish unexposed surfaces of precast architectural concrete units by float finish.

2.12 SOURCE QUALITY CONTROL

- A. Owner will employ an independent testing agency to evaluate precast architectural concrete fabricator's quality-control and testing methods.
 1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.
- C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements.
- D. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.
 1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Construction Manager.
 2. Cores will be tested in an air-dry condition.
 3. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.
 4. Test results will be made in writing on the same day that tests are performed, with copies to Construction Manager, Contractor, and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and with W.B.S. numbers.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Work: Precast architectural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Do not install precast concrete units until supporting concrete has attained minimum design compressive strength.

3.2 INSTALLATION

- A. Install clips, hangers, and other accessories required for connecting precast architectural concrete units to supporting members and backup materials.
- B. Install precast architectural concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
 - 1. Install bearing pads as precast concrete units are being erected.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting hoisting devices and use sand-cement grout to fill voids within recessed hoisting devices flush with surface of concrete.
- C. Anchor precast architectural concrete units in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.
- D. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
 - 1. Protect precast architectural concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 - 2. Repair damaged steel surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces.
- E. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.
- F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Field welds and connections using high-strength bolts will be subject to tests and inspections.
- C. Testing agency will report test results promptly and in writing to Contractor and Construction Manager.

- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.4 REPAIRS

- A. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Construction Manager.
- B. Remove and replace damaged precast architectural concrete units if repairs do not comply with requirements.

3.5 CLEANING

- A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 - 1. Wash and rinse according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION 03450